IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:		Atty. Docket No.:	003797.00060
Kenneth P. HINCKLEY et al.			
Serial No.:	09/804,383	Group Art Unit:	2674
Filed:	March 13, 2001	Examiner:	Dinh, D.
For:	METHOD FOR PROVIDING FEEDBACK RESPONSIVE TO SENSING A PHYSICAL PRESENCE PROXIMATE TO A CONTROL OF AN ELECTRONIC DEVICE	Confirmation No.:	1177

DECLARATION UNDER 37 C.F.R. § 1.131

U.S. Patent and Trademark Office
Commissioner for Patents

Sir:

We, Kenneth P. Hinckley, Steven N. Bathiche and William Vong, hereby declare as follows:

1) We are named as joint inventors of the above-identified patent application.

2) We are presently employed by Microsoft Corporation (Microsoft), and were employed by Microsoft during conception and development of the inventions in the above-identified application.

3) Microsoft is the assignee of the above-identified application.

4) Prior to October 6, 2000, the filing date of U.S. Patent No. 6,680,677, we actually reduced to practice in the United States the invention recited in pending claims 1-31 of the above-identified application.

5) Exhibit A shows two slides from a PowerPoint presentation entitled "Touch-Sensing Input Devices" (dates redacted) along with the cover slide that Ken Hinckley along with Mike Sinclair presented, which introduced the core ideas we conceived and invented. In slides 23 and 45, there is a reference to tooltips appearing when a button is touched and the notion of a time delay before the tooltip

fades and the applicability of the invention to a keyboard and a mouse as input devices. Also, a representative tooltip which indicates the functionality of "Launches My Computer" is shown in slide 23. Exhibit B, Touch 1 Usability Protocol (dates redacted), describes the process that Tim Muss, who was a usability engineer designated to test our prototype, employed for a usability test that was to be conducted with 12 subjects on a touch sensitive mouse according to our invention. Exhibit C, the Usability Report (dates redacted), was generated based on the actual usability test that was conducted as outlined in Exhibit B. Portions of Exhibit B provide background details including the Mouse Button tooltips portion of Section 2.0 and Section 4.0, Touch spotlight.

6) Exhibit C when read in view of the referenced portions of Exhibit A as well as Exhibit establishes that we had reduced to practice the invention of independent claim 1. More specifically, as referred to in the second paragraph on page 4 of Exhibit C, four features of the touch mouse were investigated including touch tooltips where a user placed a hand close to or on a mouse; "Touch of programmable mouse buttons (4 and 5) provided an application-sensitive tooltip identifying the action of the button for the current application." This section of Exhibit C provides support for each of the claim 1 steps including detecting a presence proximate to or contacting a first auxiliary control for a predefined period in which the first auxiliary control maintains an inactive state and generating feedback responsive to the detecting, the feedback providing an indication of the functionality of the first auxiliary control, the functionality of the first auxiliary control and associated feedback being dependent upon which of a plurality of first application programs is active. Further support for claim 1 can be found in Exhibit C at, among other places, pages 10-11, where participant reaction to touch tooltips is discussed. For example, inadvertent actuation of buttons is discussed.

7) Independent claim 9 calls for detecting a first physical presence proximate to or contacting the auxiliary control for a predefined period in which the auxiliary

control maintains an inactive state. Reduction to practice of this feature is described in the above paragraph with respect to Exhibit C. Claim 9 also recites the step of generating feedback responsive to the step of detecting, the feedback providing an indication of the functionality of the auxiliary control, the generating further including displaying a display widget on the display screen responsive to the step of detecting, wherein the display widget identifies a text macro, which is a block of text assigned to the first auxiliary control, and displays at least a portion of text corresponding to the text macro. Exhibit C as discussed in the above paragraph evidences reduction to practice of the claim 9 step of generating feedback providing an indication of the functionality of an auxiliary control including displaying a display widget. A tool tip is an illustrative display widget. Although Exhibit C does not evidence that the display widget identifies a text macro, which is a block of text assigned to the first auxiliary control, and displays at least a portion of text corresponding to the text macro as called for in claim 9, Exhibit D entitled "Patent Disclosure" (dates redacted) on page 4, third full paragraph shows and describes a text macro. Namely, Exhibit D describes that a text macro could be created where a block of text would be inserted when a hotkey is depressed. More pertinently, Exhibit D goes on to describe that when a key is assigned a text macro, by touching a key a user can be presented with an on screen display indicating what function (in this instance text macro) is assigned to the key and the actual text macro An illustrative on screen display is depicted between the third and fourth full paragraphs on page 4 of Exhibit D. We submit that it would have been apparent to those skilled in the art that the reduction to practice discussed in the above paragraph regarding claim 1 with respect to Exhibit C could have been easily modified and/or it would have been obvious as to how to modify our touch sensitive mouse to achieve and realize displaying the at least a portion of text corresponding to a text macro when the text macro was the assigned function of the key functionality as we claimed and as we conceived and invented as evidenced by Exhibit C

8) Independent claim 18 includes detecting a first physical presence proximate to or contacting a first auxiliary control for a predefined period in which the first auxiliary control maintains an inactive state and generating first feedback responsive to the step of detecting, the first feedback providing an indication of the functionality of the first auxiliary control. These features have been reduced to practice as discussed above with respect to claim 1 and Exhibit C Claim 18 further calls for detecting a second physical presence proximate to or contacting a second auxiliary control different from the first auxiliary control in which the second auxiliary control maintains an inactive state while detecting the first physical presence proximate to or contacting the first auxiliary control, and generating second feedback responsive to the step of detecting the second physical presence, the second feedback indicating functionality associated with the combination of the first auxiliary control and the second auxiliary control. Exhibit D on page 3, in the second full paragraph describes the steps of detecting a second physical presence and generating second feedback responsive to detecting the second physical presence, with the second feedback indicating functionality of the combination of the first and second auxiliary controls, the so-called *new* control. We submit that it would have been apparent to those skilled in the art that the reduction to practice discussed regarding claim 1 in the above paragraph with respect to Exhibit C could have been easily modified and/or it would have been obvious as to how to modify our touch sensitive mouse to achieve and realize the claim 18 steps of detecting the second physical presence while detecting the first physical presence and generating the second feedback indicating functionality associated with the combination of the first auxiliary control and the second auxiliary control as we claimed and as we conceived and invented as evidenced by Exhibit C.

9) Independent claim 28 calls for detecting a first physical presence proximate to or contacting a first auxiliary control without activating the first auxiliary control; and displaying a first display widget on the display screen responsive to the step of detecting, the first display widget providing a tool tip associated with the first

auxiliary control, wherein the tool tip is a textual label. Support for these features is at least coextensive with the support identified for the features of claim 1 as discussed above and includes the portions of Exhibit A providing background details include the Mouse Button tooltips portion of Section 2.0 and Section 4.0, Touch spotlight, and Exhibit C on pages 4, 10 and 11. Claim 20 further calls for the tool tip to indicate *one of* an identity of a user, tuning of an audio application, tuning of a video application, volume control, control of a feature with multiple settings, a control function corresponding to a key combination, and an application that will be launched by activating the first auxiliary control. As discussed above, Exhibit D on page 3 in the second full paragraph describes a tool tip indicating a control function corresponding to a key combination. We submit that it would have been apparent to those skilled in the art that the reduction to practice discussed regarding claim 1 in the above paragraph with respect to Exhibit C could have been easily modified and/or it would have been obvious as to how to modify our touch sensitive mouse to achieve and realize a tool tip indicating a control function corresponding to a button (key) combination as we conceived and invented as evidenced by Exhibit C.

10) As discussed above in connection with Exhibits A, B, C and D, the features of independent claims 1, 9, 18 and 20 were reduced to practice or it would have been apparent to those skilled in the art as to how the claimed features reduced to practice could have been easily modified and/or it would have been obvious as to how to modify our device to achieve and realize the other claimed features. Also, many of the dependent claim features were also reduced to practice as evidenced by Exhibits A, B, C and D. To the extent that we may not have reduced to practice every dependent claim feature, we submit that it would have been apparent to those skilled in the art that we had established a working device which could have easily been modified to realize any such feature and/or that it would have been obvious as to how to modify our device to achieve and realize such a feature.

11) Exhibits A, B, C and D have not been altered since they were originally prepared except for the redaction of references to dates.

12) Each of us individually represents that we are over 18 years of age and of competent mind

13) All statements made of our own knowledge are true and all statements made on information and belief are believed to be true; and further, these statements were made with the knowledge that willful, false statement so made are punishable by fine or imprisonment or both, under 18 U.S.C. § 1001 and that such willful, false statements may jeopardize the validity of the above-identified application or any patent issuing thereon.

Respectfully submitted,

/Kenneth P. Hinckley/	Feb. 5, 2007
Kenneth P. Hinckley	Date
Steven N. Bathiche	Date
William Vong	Date

11) Exhibits A, B, C and D have not been altered since they were originally prepared except for the redaction of references to dates.

12) Each of us individually represents that we are over 18 years of age and of competent mind

13) All statements made of our own knowledge are true and all statements made on information and belief are believed to be true; and further, these statements were made with the knowledge that willful, false statement so made are punishable by fine or imprisonment or both, under 18 U.S.C. § 1001 and that such willful, false statements may jeopardize the validity of the above-identified application or any patent issuing thereon.

Respectfully submitted,

Kenneth P. Hinckley	Date
/Steven N. Bathiche/	2/5/2007
Steven N. Bathiche	Date
William Vong	Date

11) Exhibits A, B, C and D have not been altered since they were originally prepared except for the redaction of references to dates.

12) Each of us individually represents that we are over 18 years of age and of competent mind

13) All statements made of our own knowledge are true and all statements made on information and belief are believed to be true; and further, these statements were made with the knowledge that willful, false statement so made are punishable by fine or imprisonment or both, under 18 U.S.C. § 1001 and that such willful, false statements may jeopardize the validity of the above-identified application or any patent issuing thereon.

Respectfully submitted,

Kenneth P. Hinckley	Date
Steven N. Bathiche	Date
/William Vong/	2/7/07
William Vong	Date

EXHIBIT A

Touch-Sensing Input Devices

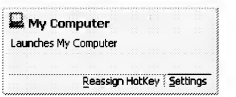
Ken Hinckley
Mike Sinclair
Microsoft Research
[redacted]

http://msrweb/groups/ui/kenh/Touch-TellAll-[redacted]

Thanks to many contributors – both from research and the Hardware product groups – for a wealth of ideas and discussions.

4. Other Examples

- VideoMouse pad (VIDEO)
- *Power management for wireless products*
- *Tooltips appear when touch a button*
  - *Time delay before tooltip fade-in*
  - *For kbd, include mouse-over actions*



- *Hover Detection: hover text dismissed when release mouse*
- Sense user activity via mouse + kbd touch
  - *Wake up on touch (screen saver etc.)*
  - Notification: timing of interruptions
  - Handedness detection
- Touch-to-Talk feature for speech input

Current Activities: Mouse/Kbd

- Mouse
  - Wireless optical mouse will ship touch for power.
  - New touch-based UI features being investig.
  - Prototypes delivered to Neptune (results???)
- Keyboard
  - AppSwitch user study
  - Touch-sensitive scrolling strip
  - Tooltip keys on touch (Mouse also – fwd/back)

EXHIBIT B

Tim Muss
Hardware Design Group

Touch 1 Usability Protocol

Study Dates: [redacted]
Subjects: 12 (6 expert, 6 advanced mouse users)

1.0 Introduction

The study focuses on three implementations of touch: fading toolbars in Word, cursor location (sonar), and tool tips for default back and forward mouse buttons.

2.0 Research Objectives

Fading Toolbars

- User feedback to fading toolbars when hand is removed from or placed on mouse.
  - Speed of fade in/out
  - Does it fade when expected?
  - Pros/cons
  - Value of this feature

Sonar

- User feedback to hiding cursor when hand is removed from mouse
- User feedback to using sonar-like display to help locate cursor upon touch of mouse
  - Can they find cursor easier than without sonar?
  - Does sonar provide too much/too little assistance?
  - Pros/cons
  - Value of this feature

Mouse Button Tool tips

- User feedback of touching mouse button for tool tips.
  - Does the tool tip appear/fade too fast?
  - Location of tool tip
  - Inadvertent actuation?
  - Pros/Cons
  - Value of this feature

Touch Technology Feedback

- What are their expectations for touch technology? How should it be used?
- What do users think of applying touch to mouse or keyboard?

Tim Muss
Hardware Design Group

1.0 Opening Interview

General
What mouse(s) do you use most often?

Would you say you use your keyboard or your mouse more often?

What software applications to you use most often?

What do you dislike most about your current mouse?

What do you think of the mouse-over tool tips?

Physical Mouse Use
Do you rest your hand on the mouse when reading/thinking?

How do you hold the mouse? What part of the hand touches the mouse?

Where do you rest your fingers/hands when using your mouse? On buttons?

Mouse Use with Software
In general, list some things you use your mouse for? (i.e. navigation, wake up computer, selection, etc.)

Does the mouse cursor ever get in the way when you are entering text?

Have you ever had trouble finding your mouse cursor on the screen?

How often do you use the toolbars? Name the most common features you use.

Have you ever programmed the buttons on your mouse to perform different functions than the default settings?

Tim Muss
Hardware Design Group

The following 3 scenarios and conditions will be presented in a counter-balanced order among the 12 users.

2.0 Fading Toolbars

Equipment: **System 1:** RTM Sedona, W2k, Word
System 2: Sedona with touch, W2k and touch drivers, Word

Method
Users will first perform a pre-determined task in Word for about 5 minutes (entering text, moving text, scrolling, etc.) on system 1 without using touch and system 2 with touch. Users will be asked to use Word toolbars and not keyboard shortcuts or right mouse button.

Objective measure

- Time to complete task for with and without touch

Subjective measures

1. What are your initial reactions to the fading toolbars?
2. Did you have trouble understanding that touching the mouse caused the toolbars to fade in and out?
3. Why do you think the upper portion of the screen was gray?
4. What are the advantages of having fading toolbars?
5. What are the disadvantages of having fading toolbars?
6. Do you think you would use this feature? Why?
7. Do you prefer the fading toolbars and the touch mouse to the standard toolbar and mouse? Why?
8. Did the toolbars fade in and out when you expected them to? Why?
9. Would you rate the speed of the fade too fast, just right, or too slow? Why?
10. Did this feature distract you from the task? If yes, explain.

11. I performed the task ...

better with the touch mouse	O O O O O	better without the touch mouse

12. Based on this feature, I feel the mouse is..

More touchable with this touch feature	O O O O O	More touchable without this touch feature

13. This feature is...

annoying	O O O O O	helpful

Tim Muss
Hardware Design Group

14. To what degree would you think this feature affects the appeal of a mouse?

This feature makes a mouse **less** appealing	O O O O O O O	This feature makes a mouse **more** appealing

3.0 'Sonar' – cursor location assistance

Equipment: System 1: RTM Sedona, W2k, Excel
System 2: Sedona with touch, W2k and touch drivers, Excel

Method

Users will perform a pre-determined task in Excel for about 5 minutes (entering text, moving text, scrolling, etc.) on system 1 without using sonar and system 2 with sonar. Users will be asked to use Excel toolbars and not keyboard shortcuts or right mouse button.

Objective measures

- Document cursor movement behavior.
  - How does the user leave the cursor when moving from mouse to keyboard?

Subjective measures

1. What are your initial reactions to sonar?
2. What are your initial reactions to the disappearing cursor?
3. Was it easy for you to notice that the cursor disappeared when you let go of the mouse?
4. Was the cursor easier, the same, or harder to find with sonar than without?
5. What are the pros of the disappearing cursor?
6. What are the cons of the disappearing cursor?
7. What are the pros of sonar?
8. What are the cons of sonar?
9. Do you feel that sonar offers too little, just right, or too much assistance for finding the cursor?
10. Were you distracted from the task by this touch feature? If yes, explain.

11. I performed the task …

better **with** a disappearing cursor	O O O O O	better **without** a disappearing cursor

12. I performed the task …

better **with** sonar	O O O O O	better **without** sonar

13. Based on this feature set, I **feel** the mouse is…

More touchable with this touch feature	O O O O O	More touchable without this touch feature

14. The disappearing cursor feature is…

annoying O O O O O helpful

15. The sonar feature is…

annoying O O O O O helpful

16. To what degree would you think the disappearing cursor feature affects the appeal of a mouse?

The feature makes a mouse **less** appealing O O O O O O O This feature makes a mouse **more** appealing

17. To what degree would you think the sonar feature affects the appeal of a mouse?

The feature makes a mouse **less** appealing O O O O O O O This feature makes a mouse **more** appealing

4.0 Touch spotlight

Equipment:	System 1: RTM Sedona, W2k, Word, IE, Excel System 2: Sedona with touch, Viper with touch, W2k and touch drivers, Word, IE, Excel

Method

Users will first perform a pre-determined task in Excel, Word, and IE for about 5 minutes (entering text, moving text, scrolling, etc.) on system 1 without using touch spotlight and system 2 with touch spotlight. Users will be asked to use toolbars and not keyboard shortcuts or right mouse button. Users will be presented a written scenario describing the pre-assignment of actions to the 'back' and 'forward' buttons.

Objective measures

- Time to complete task for each of 3 mice
- Inadvertent actuations

Subjective measures

1. What are your initial reactions to getting tool tips for each button by touch? Please comment on each of the two touch mice.
2. Do you fell about touching a button for a tool tip?
3. Please comment on the location of the tool tip?
4. Does the tool tip appear too fast, just right, or too slow?
5. Does the tool tip disappear when expected?
6. Were there any times when you did not want touching the button to give a tool tip?
7. Were there any times when you touched a button by accident?

8. What are the pros of this feature?
9. What are the cons of this feature?

10. I performed the task ...

better with the touch mouse	O O O O O	better without the touch mouse

11. Based on this feature and the touch-Sedona mouse, I feel the mouse is...

More touchable with this touch feature	O O O O O	More touchable without this touch feature

12. Based on this feature and the touch-Viper mouse, I feel the mouse is...

More touchable with this touch feature	O O O O O	More touchable without this touch feature

13. For the touch-Sedona mouse, this feature is...

annoying	O O O O O	helpful

14. For the touch-Viper mouse, this feature is...

annoying	O O O O O	helpful

15. To what degree would you think this feature affects the appeal of a mouse?

Sedona

This feature makes a mouse **less** appealing	O O O O O O O	This feature makes a mouse **more** appealing

Viper

This feature makes a mouse **less** appealing	O O O O O O O	This feature makes a mouse **more** appealing

Wrap-up Interview

1. Based on the features you saw today, how well did they meet your expectations?
2. Can you think of any applications of touch that would better fit your expectations?
3. Can you give me examples of how you think touch should be used in computer mouse design? Computer keyboard design?
4. Can you think of any downsides to using touch in mouse or keyboard designs?

EXHIBIT C

HARDWARE DESIGN GROUP

USABILITY REPORT

DATE: [redacted]

TO: Steve Bathiche, Scott Plank, David Koon, LaShaun Bellamy, Touch POC

FROM: Tim Muss

RE: Final Usability Report

CC: Hardware User Research

TITLE: USING TOUCH ON MOUSE TO CONTROL TOOLBARS, CURSOR, AND TOOLTIPS: PHASE I

EXECUTIVE SUMMARY

This study investigated how advanced to expert mouse users reacted to using touch of the mouse to control the following four major features: Fading toolbars; Disappearing/reappearing cursor; Touch tooltips; Sonar.

Nearly all participants had a difficult time determining that touch controlled these features. Most participants thought mouse movement caused the feature effects. Others thought movement of the cursor to a particular portion of the screen, the proximity of hand to mouse, the heat of hand, the red light on Sedona, or the buttons on the mouse caused the feature effects. Others didn't know

In general, participants felt that these features, especially touch tooltips, made the mouse less touchable and that they would change the way they interacted with the mouse. Some mentioned they would hold the mouse lighter, be more aware of their finger placement, or be anxious of unwanted actions cause by touching the mouse. It was noted that implementing touch, as presented here, to the Sedona mouse may cause users to interact with the mouse less, which is inconsistent with our recent focus to make Microsoft mice more form-fitting, and comfortable to use. User research to determine the accuracy of these findings is encouraged.

A majority of the users agreed that they would like to see these features in the next mouse they purchase but a clear ranking of features was not established. The greatest number of participants indicated they would like to see the touch tooltips feature in their next mouse and that the touch tooltips feature made the mouse most appealing, was the most helpful, and best fit their work style. But, participants indicated that the touch tooltips feature made the mouse the least touchable of all features. This may have been a result of participants resting their fingers on the touch-sensitive buttons. The study was unable to determine how much more, if any, users would pay for these features.

Half of the participants felt that the fading toolbars and sonar features were more annoying than helpful. Participants were split on whether they would use these features or not. Participants appreciated they could read text underneath the toolbars (when faded), but clearly reported they did not like that when they touched the mouse to edit this text, the toolbars appeared and prohibited them from editing it without scrolling. The fading toolbars on scroll was better received than by touch. Most participants appreciated the idea of a sonar feature (cursor location assistance), but found the present execution of sonar less than optimal. Participants reported that these features were, or may become, distracting with prolonged use.

Reactions to a disappearing/reappearing cursor without sonar were mostly positive. The present implementation of this feature was nearly transparent to participants. No participant reported having trouble using this feature. Only two felt that this feature was more annoying than helpful. However, of the four features presented, participants felt this feature contributed least to the appeal of the mouse.

Participants indicated that they might only use these features for a short period. Participants mentioned they wanted more control over feature performance, including to turn them off. Participants felt once they learned the programmable button configuration, they would want to turn off the touch tooltips. Participants also felt that fading toolbars and sonar to be either too distracting or not appropriate to have on at all times and would want to turn them off as well. Furthermore, participants mentioned they would not use these features if they noticed any decrease in system performance.

Participants felt touch has potential to enhance user experience. It was evident touch 'wowed' participants and most were excited of the novelty of the features after the touch features were explained. One participant mentioned, 'touch created a deeper relationship with the mouse' and another, 'I like that the mouse is responding to me'. This study suggested that participants found touch to be more of an emotional connection to the computer than a physical 'switch'. Three participants mentioned touch would be a great addition to the gaming experience. Most were more excited about the potential of touch than of the features presented in this study.

This study suggests that using touch sensitivity on a mouse to control these features may not be the best implementation of touch technology for the end-user. Since touch was not easily understandable to users as presented in this study, it may be a clear sign this implementation did not match the expectations of an office user. Next steps may be to take a broader approach and perform more generative research of user expectations, perceptions, and perceived value of touch in a variety of contexts to determine which, if any, input device best supports the technology.

BACKGROUND

This study was conducted on [redacted]. The study follows previous work conducted by Microsoft Research on applying touch sensitivity to input devices (Hinckley and Sinclair, 1999: Internal http.//msrweb/groups/ui/Papers/touch-sensing.doc)

The present study investigated how users reacted to using touch of the mouse to control four major features. Characteristics of the user pool are described in Appendix A. Placing the hand close (<1/2") to or on the mouse (hereafter referred to as touch) and removing the hand (hereafter referred to as release) resulted in the following actions.

- **Fading toolbars**. Toolbars faded in on touch and faded out on release. Scrolling with the mouse scroll wheel or using the side scrollbar caused toolbars to fade out. Movement of the mouse caused the toolbars to fade in.
- **Disappearing cursor.** Cursor disappeared on release and reappeared on touch.
- **Sonar**. A series of circles zeroed in on the cursor on touch. No action on release.
- **Touch tooltips**. Touch of programmable mouse buttons (buttons 4 and 5) provided an application-sensitive tooltip identifying the action of the button for current application Tooltip disappeared on release or after a short timeout.

Research Questions

The study focused on the following research questions:

- How do users presently use tooltips, toolbars, and their mouse cursor?
- What is the discoverability of a touch sensitive mouse? Do users understand that touching the mouse controlled the above on-screen features?
- Would users want to see these features in their next mouse purchase?
- How do users rank these four features?
- Which feature is most appealing, and which feature is least appealing?
- Do users find these features helpful or annoying? Do these features fit in with their preferred work style? Is there too much going on in the screen?
- Do users find the mouse more or less touchable?
- What are the user reactions to each of the above features?

Methods

Users were first exposed to one of the following conditions followed by the other. Order was counter-balanced. All users completed an initial verbal interview and completed paper-based surveys after each condition.

- **Sonar and disappearing cursor with touch tooltips.** Users were informed of the predetermined assignment of the programmable buttons. (IE: back/forward; Excel: copy/paste; Word: undo/redo). A series of verbal commands were given requiring them to switch between the three applications, enter text, and use the two programmable buttons. Users completed the task using first the Sedona mouse design and followed by the Viper mouse design (Appendix B). Initial and post-task reactions to the features were recorded.
- **Fading toolbars and disappearing cursor.** Users were asked to complete a simple form in Word requiring them to scroll, use the toolbars, and enter text using the Sedona mouse. Initial and post-task reactions to the features were recorded.

RESULTS

1.0 How do users presently use tooltips, toolbars, and their mouse cursor?

What are the major likes and dislikes of participants' present mouse?
Users appreciate that their present mouse is fast, quiet, and lightweight. At least half of the participants used a scroll wheel and all really enjoyed the feature. All participants mentioned they leave their hand on the mouse while reading, thinking, or waiting for an application to load. One participant wanted the scroll wheel to have a 'smooth' setting that wouldn't make scrolling so choppy both mechanically and on-screen. One participant mentioned he would like the light on the Sedona mouse to turn off at night, even when his computer is on.

How do participants use tooltips?
Participants do use tooltips, but rarely. They use them mostly when they don't understand what an icon represents and when they are learning a program. They also use them to get file information and to see the <alt image> html tag while viewing web pages. At least three participants mentioned that the tooltip presently appears too slow and it takes to much work to make them appear (repositioning cursor over icon and waiting) or they stay visible for too long. Other participants mentioned tooltips are good for novice users and non-critical information, but sometimes the information in the tooltip isn't useful. Participants wanted more information on demand (like the ability to go to a web page for more information), consistency in all applications, and the ability to adjust content and speed. Only three of ten participants reported that the tooltips have ever gotten in the way.

How do participants use toolbars?
All participants mentioned they use toolbars. Only two participants reported they use hot-keys more than toolbars. Two participants never turn off the toolbars because they like the quick reference. Eight participants rarely turn off toolbars and do so to have more screen space or to make screen less distracting when writing. Participants appreciate they can customize and undock the toolbars. They would like toolbars to me more flexible (i.e. customizable skins for more friendly look and feel, re-size icons) and be more consistent between applications.

Do participants have any issues with their mouse cursor?
Six subjects mentioned the mouse cursor does get in their way after entering text or typing. Two participants mentioned specifically that the 'I' cursor in Word is most annoying. Seven participants mentioned they had trouble finding the mouse cursor on the screen as a result of the following: screen glare, a touchy pointing device, when mouse cursor goes off the screen, is on similar colored backgrounds, or when software is loading. Participants mentioned they didn't want the mouse cursor to be able to go off the screen, they wanted to have the mouse cursor center itself after a period of non-use, and to be able to change the size of the cursor (i.e. pixel by pixel). One participant reported he used his mouse cursor to tell him if his system has locked-up.

2.0 What is the discoverability of a touch sensitive mouse? Do users understand that touching the mouse controlled the above on-screen features?

- **Nearly all participants were unable to determine that touch controlled the tested features.** After exposures to touch (without any explanation) and a short experimentation period, participants were asked what they thought controlled the tested features. Most participants thought mouse movement caused the feature effects. A list of responses are as follows:
  - Mouse movement
  - Mouse movement toward gray, shaded area (fading toolbars)
  - Proximity of hand to mouse
  - Heat of hand
  - The rear, red light on Sedona
  - Touch of the buttons on the mouse
  - I don't know

  After participants were told that touch of the mouse body controlled the tested features, all understood how to use touch and nearly all were intrigued by the novelty of an unfamiliar technology.

Severity	Scope	Issue	Recommendation*
2	1.5	Understanding how to accurately control/use touch to operate tested features	Use visual design cues to clearly identify that by touching the mouse will result in action. Participants mentioned using brighter colors for touch areas, 'squeezable' materials, and a touch-friendly product name.

*Severity and Scope is explained in detail in Appendix C

- **In general, all participants were impressed and intrigued by the novelty of using touch to control features on the screen.**

3.0 Would users want to see these features in their next mouse purchase?

- A majority of the users agreed that **they would like to see these features in their next mouse they purchase.**

Feature	YES
Touch Tooltips	78% (7/9)
Sonar/Cursor on Touch	67% (6/9)
Fading Toolbars on Scroll	67% (6/9)
Fading Toolbars on Touch	56% (5/9)

4.0 How do users rank these four features?

- As a group, **users did not establish a clear ranking for features.** Feature rankings were not determined to be significantly different from each other (Friedman Analysis). *8 Subjects Responded

	Rating Frequency			
Feature	**1st**	**2nd**	**3rd**	**4th**
Touch Tooltips	3	2	2	1
Sonar/Cursor on Touch	4	1	1	2
Fading Toolbars on Scroll	1	3	2	2
Fading Toolbars on Touch	1	2	3	2

5.0 Which feature is most appealing and which feature is least appealing?

- More users felt that **these features made the mouse more appealing than less.**
- No user thought the touch tooltip feature made the mouse less appealing.

Make the mouse more or less appealing?

			Frequency [Less] 1 2 3 4 5 6 7 [More]						
Feature	**Mean**	**Less:More Appealing Ratio**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Touch Tooltips	5.6	0:8	-	-	-	2	2	4	2
Fading Toolbars	4.8	2:7	-	2	-	1	3	3	1
Sonar	4.7	3:6	-	2	1	1	2	2	2
Disappearing Cursor	4.5	1:6	1	-	-	3	4	2	-

6.0 Do users find these features helpful or annoying?

- Overall, more users felt that **touch tooltips, disappearing cursor features were more helpful than annoying**.
- Users were equally split in their feelings that the sonar and fading toolbars features were either helpful or annoying.

Annoying or helpful?

			Frequency [Annoying] 1 2 3 4 5 [Helpful]				
Feature	**Mean**	**Annoying:Helpful Ratio**	**1**	**2**	**3**	**4**	**5**
Touch Tooltips	4.1	1:9	-	1	-	6	3
Disappearing Cursor	3.4	2:5	1	1	3	3	2
Sonar	3.2	4:4	2	2	2	-	4
Fading Toolbars	3.0	4:4	2	2	2	2	2

7.0 Do these features fit in with their preferred work style?

- Overall, more users felt that all of these features fit into their work style than felt they didn't fit.
- **The touch tooltip feature fit the most users' work style.**

Fit users' work style?

			Frequency [Annoying] 1 2 3 4 5 [Helpful]				
Feature	**Mean**	**Doesn't Fit: Fit Ratio**	**1**	**2**	**3**	**4**	**5**
Touch Tooltips	3.5	1:6	1	-	3	5	1
Sonar	3.3	4:5	2	2	1	1	4
Disappearing Cursor	3.2	4:5	1	3	1	3	2
Fading Toolbars	3.0	3:4	3	-	3	2	2

8.0 Was there too much going on in the screen?

- More users felt that **there was too much going on in the screen because of the fading toolbars and the sonar features.**

Too much going on in the screen?

			Frequency [Annoying] 1 2 3 4 5 [Helpful]				
Feature	**Mean**	**Disagree:Agree (that too much was going on)Ratio**	**1**	**2**	**3**	**4**	**5**
Touch Tooltips	2.3	7:1	1	6	2	1	-
Fading Toolbars	3.3	3:5	-	-	2	3	2
Sonar	3.3	3:6	2	1	1	4	2

9.0 Do users find the mouse more or less touchable?

- Overall, more users felt that **adding touch capability to the mouse made it less touchable** for all features.

More or less touchable?

			Frequency [Less] 1 2 3 4 5 [More]				
Feature	**Mean**	**Less:More Touchable Ratio**	**1**	**2**	**3**	**4**	**5**
Touch Tooltips	2.4	6:2	2	4	2	2	-
Sonar	2.5	6:4	4	2	-	3	1
Fading Toolbars	2.7	6:4	3	3	-	2	2
Disappearing Cursor	2.9	5:4	-	5	1	4	-

- **In general, participants felt that they would hold the mouse different because of the touch sensitivity.** Participants mentioned they may hold the mouse lighter, be more conscious of where their fingers were on the mouse, and not rest fingers on mouse buttons. Furthermore, some felt they would keep hand off the mouse more or be anxious of removing hand from the mouse in fear of unwanted on-screen actions (causing the toolbars to vanish). These implementations of touch could encourage a completely

opposite user experience than our recent, form-fitting mouse designs which are intended to make mice more touchable use more comfortable.

10.0 Participant reactions to fading toolbars

In general, the initial reaction to fading toolbars was of surprise to participants. It was clear that most did not expect the toolbars to appear with mouse interaction. However, at least six participants mentioned they liked the fading toolbar feature on scroll. The three major obstacles for this feature are as follows:

- **Reappearing toolbars over text.** "It is hard enough for me to find stuff on the screen, when I do find it, don't hide it from me!" This is a fundamental problem caused by showing users text that will be covered by the reappearing toolbar as soon as they move the mouse after scrolling or touching the mouse after typing. This causes users to have foresight to position the text of interest outside of the area where the toolbars will reappear. The grayed area on the screen to denote where the toolbars would reappear did not solve this problem. Participants mentioned that this single issue would cause them to use this feature less or not at all.
- **Limited target user group.**
  - *Users with large monitors.* Users who do not need/want additional screen space for viewing documents may not be interested in this feature. One participant with a 21" monitor mentioned he had no use for this feature.
  - *Users who prefer to see toolbars 100% of the time.* At least two participants mentioned they like having toolbars on all the time.
- **Longevity of feature use.** Some participants mentioned they would 'give fading toolbars a try' or that fading toolbars 'would add another learning curve' to their computing experience. At least four participants mentioned the feature was distracting. These comments may indicate that users might look to turn off this feature after continued use even though the feature intrigues them after a short exposure.

Severity	Scope	Issue	Recommendation
2	1	Reappearing toolbar over text (see above)	No obvious solution, yet.
2	2	Fading toolbars are distracting	Allow users more control over when and how toolbars appear/disappear or to turn feature off.
2	2	Touch of mouse doesn't accurately represent when user will want toolbar to appear or disappear	More user research to determine when users do want toolbars and when they do not.
2	2	Users don't understand what exactly controls the fade in and out of toolbars	Provide more design cues to help users understand the cause and effect of this feature.
2	3	User doesn't want passive touch of the mouse to control fade of toolbars	Consider other mechanisms, such as a mouse button, to provide user with an active means to trigger toolbars.
3	1	Fading toolbars do not perform consistently in all software applications	Ensure consistent performance between all software applications.
3	1	The fading toolbar feature causes slowed system performance	Avoid reduced system performance, excessive writing to hard drive, or jerky

Severity	Scope	Issue	Recommendation
			mouse movements.
4	3	User wants a faster or slower or immediate fade in or out	Allow users more control over when and how toolbars appear/disappear.
4	3	User expects toolbars to fade in after scrolling with scrollbar	Make the toolbars fade in when user moves cursor out of scrollbar area.
4	3	User wants to have fading toolbars in one application but not another (i.e. no fading toolbars in Word but want in IE)	Allow user to turn fading toolbars on and off for different applications.

11.0 Participant reactions to touch tooltips

Participants generally welcomed this feature even though they had some difficulty controlling when the tooltips appeared for both Sedona and Viper mouse designs. Most participants felt having touch tooltips made using programmable mouse buttons easier to use.

- **9 out of 10 participants agreed that controlling touch tooltips was much easier with Sedona than Viper.**

Sedona
Participants generally found the performance of touch tooltips with Sedona to be usable but had some difficulty controlling the appearance and disappearance of the tooltip. Participants generally appreciated the idea of touching a button to get information about the use of that button

The three major obstacles to this feature are as follows:

- **Controlling touch tooltips.** Participants complained of having difficulty getting the tooltip to appear when they wanted it and also not having it appear because of accidentally touching a touch-sensitive button. Some found the buttons too sensitive for resting their fingers on because with every tiny movement of their finger caused the tooltip to appear. Some found that simply using the programmable buttons was too difficult and required them to re-position their entire hand just to activate a side-button.
- **Limited target user group.** Participants tested were advanced or expert mouse users. In general, at least three participants were enthusiastic about having programmable buttons on a mouse. However, only a few participants mentioned that they would use the programmable buttons on Sedona.
- **Longevity of feature use.** Of those participants who would program the side buttons on Sedona, at least three mentioned they would not program the buttons to perform different tasks in different applications. They mentioned they would either not need a touch tooltip or would like to disable them after they become familiar with the button use.

Severity/Scope issues for the Sedona mouse design:

Severity	Scope	Issue	Recommendation
2	1	Inadvertent actuation and touch of side mouse buttons	Consider the following: Include a time delay between touch of button and tooltip. Make mouse buttons less sensitive to touch (i.e. increase tooltip actuation pressure).
2	1	Incorrect tooltip was displayed	Ensure that correct tooltip is displayed with user touches front button and slides

			finger back to rear button.
2	2	User has difficulty physically using programmable buttons	Ensure mouse buttons are optimally placed for ease-of-use and touch technology
2	3	User has a difficult time determining why tooltips are appearing	Use design to educate/indicate about touch features.
3	1	Tooltip persisted too long	Shorter time that tooltip remains on screen. Tooltip should vanish upon release or press of button or mouse movement.
3	1	Tooltip appears in the way of user focus on screen	Consider implementing a 'smart' placement of tooltip (i.e. not over text)
3	4	User wants to turn off feature or turn off feature in specific apps.	Perform user research to determine optimal settings of tooltip content, speed, and sensitivity to maximize user satisfaction. Allow users the ability to turn feature off.

Viper

Nearly all participants had difficulty using Viper without accidentally touching or actuating the right- or left-side buttons. Nearly all participants rested their ring finger on the right-side button and that resulted in excessive, inadvertent touch tooltips during use. Participants also commented that pressing the left-side button caused them to accidentally press the right-side button. Most participants reported they had to re-position their hand in awkward positions to use the left- and right-side buttons. Participants indicated Viper was nearly unusable with active right- and left-side buttons and became even more so with the addition of touch tooltips. One participant mentioned, "that mouse is anti-touch!"

Severity/Scope issues for the Viper mouse design:

Severity	Scope	Issue	Recommendation
1	1	Inadvertent actuation and touch of side mouse buttons	Avoid positioning side-mouse buttons directly opposite of each other. Ensure users are able to use mouse without resting any part of the hand on a touch-sensitive button.

12.0 Participant reactions to disappearing/reappearing mouse cursor

The implementation of this feature was so transparent to the participants that nearly all didn't notice that the cursor disappeared and reappeared by touch of the mouse. Only one participant mentioned he would like to have the cursor visible at all times. He also mentioned that he uses the behavior of his cursor as an indicator of his system's performance. Without it, he assumes the system has locked. All other participants welcomed the feature. No participant reported having trouble finding the cursor after release, even when tested without sonar. One participant mentioned he would like the following additions to the cursor's behavior.

- Would like cursor to center itself after a period of non-use
- Not be able to go off the screen

Severity	Scope	Issue	Recommendation
2	1	Cursor relocates to the bottom right corner of screen at unexpected times on return	Correct this bug

13.0 Participant reactions to sonar

Participants were quite taken back and surprised by the appearance of sonar. Some had mentioned they weren't sure what just happened, it was too profound, and that it bothers the eyes (like when you look at a camera flash). Some thought the idea of assisting the user in finding the cursor was great, but didn't appreciate the execution as presented. Participants were not clear on what controlled the appearance of sonar. Most thought it related to mouse movement. It was evident sonar assisted participants in finding their cursor, but not all participants wanted this assistance. The two major obstacles for this feature are as follows:

- **Limited target user group.** Most participants had mentioned they don't need assistance finding their cursor on the screen. This feature may have been better received by users desiring assistance or as an accessibility feature.
- **Longevity of feature use.** Participants who reported they would use it all of the time also mentioned it may become more distracting over time. This may be a feature that users look to turn off after a short period of use.

Severity	Scope	Issue	Recommendation
2	1	Partial circles remain on screen or additional circles appear when sonar is near edge of screen	Correct this bug.
2	3	User has a difficult time determining what controls sonar.	Use design to educate/indicate about touch.
3	2	The circles are distracting.	Draw attention to the cursor more subtly. Consider lighter, smaller, and less circles. Also, instead of circles, consider making a different color cursor, brighter cursor, flashing cursor, or throbbing cursor on return.
3	2	User wants to turn off or control speed of circles	Allow users the ability to customize the performance of sonar.

14.0 Future research questions

- How do users feel about touch? What is the best implementation?
- What is the value of these features for users? Are these features compelling? Would users pay more for these features? Can we mimic 'touch' behavior with mouse movement?
- When do users want toolbars present? Not present? How long would it be before users turn off the fading toolbars, if ever? What application and user groups does this feature compliment the best?
- Will users program Sedona side buttons to perform differently in different applications suggesting they may need assistance remembering their functions?

How long would it be before users turn off the touch tooltip, if ever? What applications and user groups does this feature compliment the best?
- What is the optimal sensitivity of the programmable buttons to activate the touch tooltips? What is the optimal placement of the programmable buttons to control touch tooltips?
- Are there any long-term consequences of a disappearing cursor? Which applications support a vanishing cursor worst? How can we address these issues if present?
- How do we make touch more understandable with design?
- How do these features work together?
- Can touch enhance the gaming experience?

15.0 On-line highlight media clips

- Reactions to touch tooltips with Sedona
  \\timmuss-n1\HUE Web\HURproject\Touch-1\Highlights\Tooltips.asf
- Reactions to fading toolbars
  \\timmuss-n1\HUE Web\HURproject\Touch-1\Highlights\Fading_Toolbars.asf
- Reactions to sonar
  \\timmuss-n1\HUE Web\HURproject\Touch-1\Highlights\Sonar.asf
- Touch or mouse movement?
  \\timmuss-n1\HUE Web\HURproject\Touch-1\Highlights\Touch_vs._Movement.asf
- Hold mouse different because of touch? Comments about using Viper
  \\timmuss-n1\HUE Web\HURproject\Touch-1\Highlights\Mouse_Grip.asf
- User provides his insight for marketing touch (PG-13)
  \\timmuss-n1\HUE Web\HURproject\Touch-1\Highlights\Marketing_Insight.asf

APPENDIX A: PARTICIPANTS

Number: 10

Gender: 7 Male/3 Female

Average Age: 39.2 years (25-56 years)

Age Group (years)	20-29	30-39	40-49	50-59
Frequency	2	4	2	2

Handedness 1 Left/9 Right

Mouse Handedness 10 Right

Computer Use:
Days per week: All reported they use a computer everyday
Hours per day:

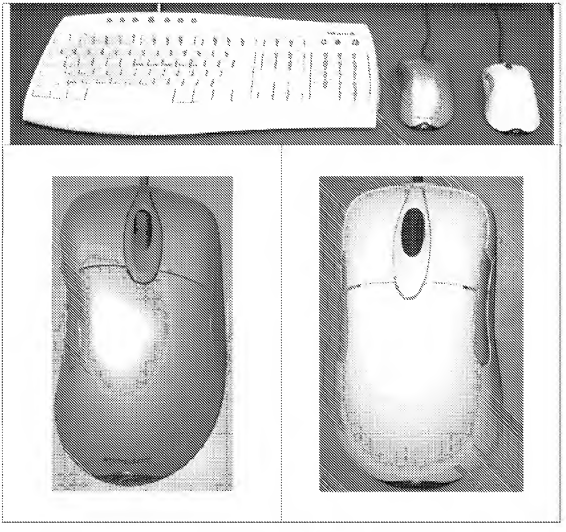
Hours per day	3-4	5-6	7-8	9+
Frequency	1	1	2	6

Self-Perceived Computer Experience:
Mean Experience 5.6 (Scale: 1=beginner; 7=expert)

(Scale: 1=Strongly Disagree , 7=Strongly Agree)

Question	Mean
My friends think of my as a knowledgeable source of information for computer software.	6.0
If I bought a new computer, I would be likely to purchase a new mouse (other than the device that was sold with my new computer) that better suits my needs.	5.9
I know a lot about the different brands of computer mice.	4.6
I would put a lot of time into selecting a replacement mouse.	5.0

APPENDIX B: IMAGES OF SEDONA AND VIPER MOUSE DESIGNS



Top: (left to right) Image of keyboard and two mice used. Left: Sedona mouse design. Right: Viper mouse design.

APPENDIX C: SEVERITY AND SCOPE EXPLAINED

Severity indicates the seriousness of the problem:

- **Severity 1** problems prevent users from being able to complete a task. Participants give up after a few tries or they need a hint to continue. For example, users consistently select an incorrect dialog option and do not know what else to do.
- **Severity 2** problems create significant delay in completing the task or create significant frustration for the user. Participants continue to get lost or to use inefficient methods to accomplish a goal. For example, the lack of feedback to users confirming what they have just done causes them to do the task over to make sure they did it correctly.
- **Severity 3** problems have as a minor effect on usability, or are enhancements that can be made in the future. For example, an unusual term in a dialog causes users to hesitate for a moment before making the correct choice.
- **Severity 4** issues are not problems *per se*, but are issues that affect fit and finish, perceived quality, and/or overall satisfaction.

Scope indicates the proportion of users affected by the problem:

- **Scope 1** problems will affect all users. This type of problem is likely to be encountered by any user using the system.
- **Scope 2** problems will affect about half of the users. Not everyone will have this problem, but a lot of users will.
- **Scope 3** problems will affect less than 1/3 of users. Some users will encounter this problem, and if it is of high severity it could have a large effect on perception of the product.

REFERENCES

Hinckley, K. and M. Sinclair (1999). Touch-Sensing Input Devices. **ACM CHI'99 Conference on Human Factors in Computing Systems**, 223-230.

EXHIBIT D

Patent Disclosure

Title of Invention: Touch Sensitive Input Controls for User Feedback of Software Functions
Date: [redacted]
Document Author(s): Ken Hinckley, Steven Bathiche, and Peter Denniston (for the pop-up UI designs)

1. Prior Disclosure

Has there been any disclosure of this invention outside of Microsoft Corporation and its subsidiaries?
No

2. Introduction

Input devices such as computer mice, keyboards, or game controllers often include many secondary inputs such as buttons, wheels, levers, triggers, sliders, or other mechanisms. The user typically has no interactive means of discovering how to use each control without reading the manual, or just trying out each button to see what it does. Furthermore, even if the user learns the assignment of the buttons and other controls in one game or application, another game or application may assign the same buttons or controls to different features. The present invention addresses this problem by having an On-Screen Display (tool tips, help, or other information) appear (or even with auditory feedback or tactile feedback) based on *contact* or extreme proximity of the user's hand with touch-sensitive button(s) or other controls. The user can thus merely touch different buttons or other controls to explore their function assignments.

3. Problem Addressed

What is the motivation of the invention?

This invention helps the user to discover the function of input device controls. It also reminds users of the current functional assignment of input device controls. All of this information is provided based on user contact with touch-sensitive portions of the input device case. The user does not actually have to press a button and then guess at what the resulting action was. Just by resting on the control in question, informative help text or further options to customize the device behavior can be displayed, prior to actually activating the control. This helps to familiarize the user with the controls, as well as to prevent unintended activation of an incorrect control when the user is not sure of its current function assignment.

What was done prior in the field?

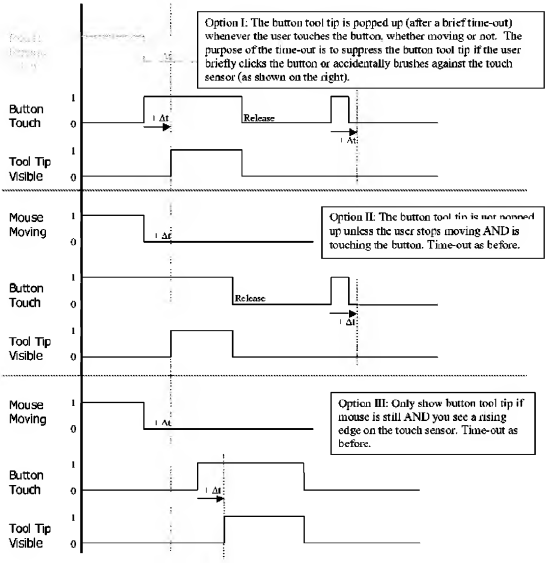
Typically the user must rely on printed materials, or alternatively a help file or screen which appears on the display when the user clicks a button or selects a menu option to request help. Sometimes the software will have a special mode where the user can *press* a button and see the function of that button highlighted on the screen.

4. Description of the Invention

By touching a button or a control on an input device the user requests the function of that control to be revealed. This can be communicated by 1) visual feedback either on the screen or on the actual button or by 2) acoustic or tactile feedback. The concept of touch buttons is extensible to almost any input device—mouse, keyboard, trackballs, game pads, joysticks, steering wheels, monitors, and headsets (Game Voice)—on any number of applications—productivity, games, and utility.

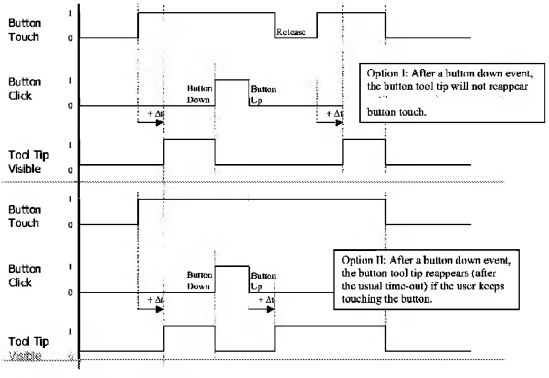
Hardware: A touch or proximity sensor is used to detect when the users hand(s) or finger(s) are in contact or extreme proximity to some portion of the input device. One or more portion(s) of the input device detect contact and can generate unique messages for the host computer based on which portion(s) of the input device the user is touching. Note that the user may be touching more than one control simultaneously. In some cases, feedback (e.g. audio feedback) may be provided directly by the input device and may or may not be shared with a host computer.

Interactive Behavior: Touch-sensitive buttons or other controls provide a tool-tip when the user touches the control. We have implemented multiple possible policies for when a tool-tip or other information or feedback should appear, based on user contact with the control, time-outs, and other information such as mouse movement. The following figure shows three such options, discussed with reference to an embodiment of a touch-sensitive mouse button that causes a tool tip to appear on the screen.



Another aspect of our touch-sensitive input control technique is the response of the tool tip or other feedback to user activation of the button or other input control. After the user activates the control, the user may no longer want the feedback of the resulting action. For example, at the time the user clicks the button (button down

event), the button tool tip can disappear instantly (or fade out). The button tool tip can also reappear after the button up event occurs if the user is still touching the button, or it can stay hidden. The system may also display visual feedback to tie the button click to the information displayed in the tool tip before the tool tip disappears.



Another issue is the handling of simultaneous contact with multiple controls on the input device. If the user touches a new control while still maintaining contact with a previously touched control, the on-screen display or other feedback for the *new* control should be provided. If the user then releases the new control, the on-screen display or other feedback can be dismissed entirely, or the feedback for the previously touched control can be reinstated.

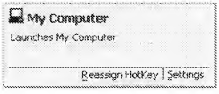
Visual Feedback: For visual feedback on the screen in response to user contact with a touch-sensitive control, there are many possibilities. One simple possibility is to display a standard tool tip, such as those illustrated below:

Copy or Paste

Typically, the on-screen display can be placed near the current mouse cursor position (regardless of the input device that the user touches – for example, a keyboard tool tip could appear next to the mouse cursor). In particular we have found popping up the on-screen display to the right of and above the current mouse cursor position to be useful, since this does not conflict with traditional tool tips which appear when the user dwells with the mouse over an icon (tool tip appears to the right of and below the mouse) in the Windows operating system. The tool tip can follow the cursor as the user moves the mouse, or it can remain stationary at the point where it initially appears. The latter technique is easier to implement and is more efficient, and seems well-accepted by most users. Other alternatives are to display the information at the center of the screen, at the bottom of the screen, or above the system tray icons.

More elaborate on-screen displays are also possible. Here we illustrate several examples that show how programmable keyboard hot keys and function ("F") keys could make their function visible on a per application basis. If a user simply touches the key (without depressing it) the on-screen display will indicate what the key is and/or what it does - without actually performing the function. This examples shows on-screen display of a keyboard hot-key, as well as mouse-selectable options to customize or view settings of the keyboard hot-key.

Another more detailed version might look like the following. This informs the user what the key is and what it does.



To take this idea even further, a feature we are considering for some future release is the ability to create text macros (the ability to insert blocks of text when the hotkey is depressed). When used in this context, we could display what the key is assigned to and the actual text macro. The on-screen display window would resize according to the amount of text assigned to the text macro.

Note that this feature is also very useful to replace LED's or other indicators on keyboards and other devices. For example, users would merely have to touch the NUM lock, Scroll lock, and Caps lock keys and the on-screen display would indicate the state of the key - on or off. This feature is useful for wireless products that may not wish to include LED's for power consumption reasons.

Acoustic Feedback

Audio or tactile feedback can be used in combination with or separately from visual feedback on the display. In some cases, visual feedback is not appropriate, or acoustic feedback may be desired because of the currently running application, the input device that is currently being used, or user preference.

For example, our new Game Voice product consists of a headset microphone combination attached to a puck. This puck allows you to selectively talk to multiple combinations of people and teams you are playing with. Each person is automatically assigned a code (1,2,3..) and a team (A,B,C ...). A problem arises when the player has to remember which code corresponds to which player and team. When the user wants a reminder to whom a button is assigned to, the current implementation is to press and hold that button. The user then receives audio feedback of the name via their headset. Pressing and holding the button takes time for this form of feedback. The concept of feedback based on touching the button can be applied here instead.

5. Related Writings or Products

Any related writings? If so, please identify.

We published papers (Hinckley, Czerwinski et al. 1998; Hinckley and Sinclair 1999) and filed patents on the basic concepts of touch-sensing input devices approximately 2 years ago. The present invention of **Touch Sensitive Input Controls for User Feedback of Software Functions** may need to be filed as a new patent or extension of the previous filings.

Our previous filings that relate to touch-sensitivity include the following:

- Proximity Sensor in a Computer Input Device (96414.1)
- Method of Interacting with a Computer Using a Proximity Sensor in a Computer Input Device (116279.1)
- A Technique for Implementing an On-Demand Display Widget through Controlled Fading Initiated by User Contact with a Touch Sensitive Input Device (116620.3)
- A Technique for Implementing an On-Demand Tool Glass for Use in a Desktop User Interface (116620.2)
- A Technique for Implementing a Two-Handed Desktop User Interface for a Computer (115205.1)

6. Microsoft Products

Is this invention intended for use in any Microsoft Products?

This feature is being considered for future mouse, keyboard, and possibly gaming devices as well.

Hinckley, K., M. Czerwinski, et al. (1998). Interaction and Modeling Techniques for Desktop Two-Handed Input. Proceedings of the ACM UIST'98 Symposium on User Interface Software and Technology, San Francisco, Calif., ACM, New York.

Hinckley, K. and M. Sinclair (1999). Touch-Sensing Input Devices. ACM CHI'99 Conf. on Human Factors in Computing Systems.